LANDSCAPE SCALE ASSESSMENT OF SURFACE WATER QUALITY IN OIL PALM PLANTATIONS : A Preliminary Study

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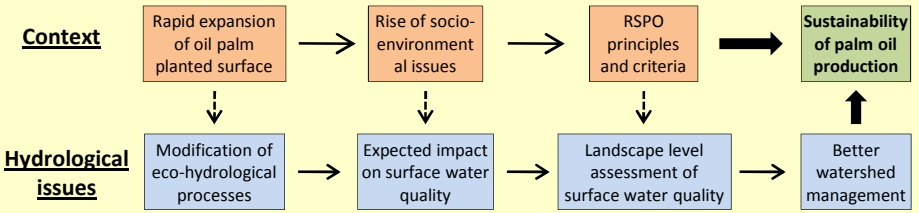
INTRODUCTION



Objectives 1- Conduct a landscape-scale assessment of surface water quality in a diversified landscape, dominated by oil palm cultivation (industrial and smallholder)

2- Compare the impacts of oil palm cultivation on surface water quality in the industrial area versus smallholder area

MATERIALS AND METHODS

Study area

Fig 1. Map of Sumatra island, Indonesia

Sampling design

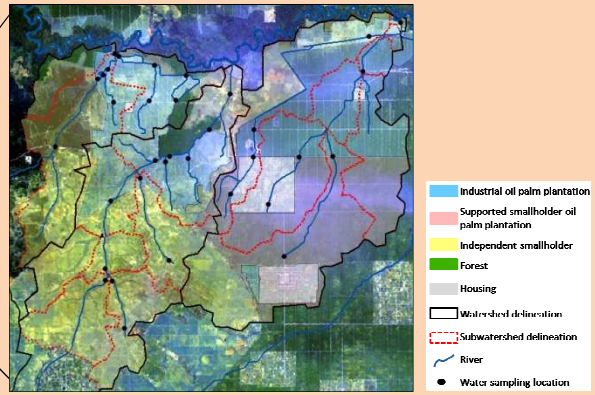


Fig 2. Map of the study area in Kampar district, Riau, Sumatra, Indonesia

Water quality parameters

Parameters impacting the Aquatic Ecosystem*

pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS),NO_3, NO_2, total P

Others*

Total Dissolved Solids (TDS), Electrical Conductivity (EC), Total Alkalinity (TA), Total K, Ca, Mg, Mn, Fe, B, Cl

*Analyzed weekly (Aug-Sept 2009)

Statistical analysis

1- Comparison of the average values of all sampling points to the Indonesian water quality standard (class 2 : recreational uses such as bathing, washing, fishing…).

2- Analysis of Variance to compare the impact of land management (Industrial versus smallholder) on surface water quality in primary tributaries.

RESULTS

1- Landscape-scale assessment of water quality

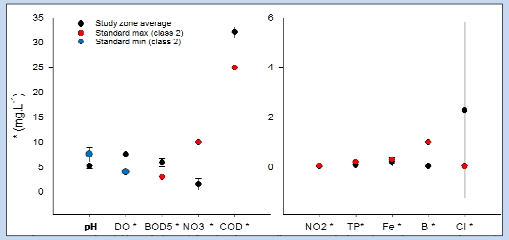


Fig. 3 Average values (with standard errors) for selected water quality parameters in the study area compared to Indonesian water quality standard (class 2)

+ Average values of nitrates, nitrites, total P, Fe and B did not exceed critical levels

− pH was more acidic, BOD and COD exceeded the maximum standard limits

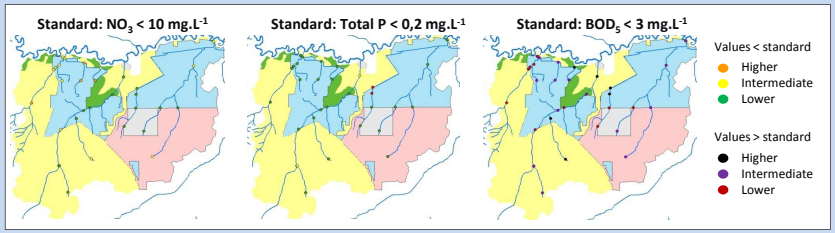


Fig. 4 Spatial distribution of average values of NO_3, total P and BOD_5 compared to Indonesian water quality standard (class 2)

2- Industrial versus smallholder areas

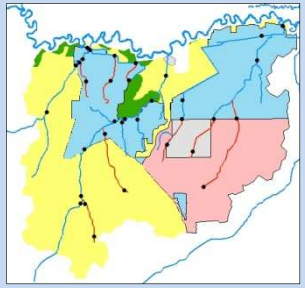


Fig. 5 Primary tributaries included in the analysis of variance (red)

≠ EC, TDS, NO_3, TP and TK concentrations were significantly greater in the industrial area than in smallholder area

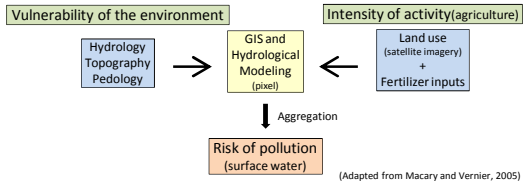
= No difference in DO, pH, TA and BOD_5 between areas with contrasting land management

Table 1. Results of the analysis of variance comparing the effect of land management on selected water quality parameters.

Parameters	Average values Ind	Average values SH	ANOVA (α = 0.05)
EC	17,1	14,8	*
TDS	77	64	*
NO_3	3,0	0,72	**
Total K	1,2	0,5	**
Total P	0,04	0,06	*
DO	7,7	7,5	NS
pH	5,0	5,0	NS
TA	8,0	7,8	NS
BOD_5	6,0	6,3	NS

(Ind : Industrial area ; SH : smallholder area ; * : p<0.05; ** : p< 0.001; NS : non significant)

PERSPECTIVES : Construction of a spatial pollution risk indicator for oil palm plantations



(Adapted from Macary and Vernier, 2005)

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References

Johnson *et al.*, 1997 ; Lord and Clay, 2006 ;
Macary and Vernier, 2005 ; Sheil *et al.*, 2009.